Technical Memorandum

for

SA5 and Axtell Creek Contaminated Sediment Removal Operations

Portage Creek Area Removal
Kalamazoo, Michigan

Prepared for:

USEPA Region 5
Emergency Response Branch
77 West Jackson
Chicago, IL 60604

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1. INTRODUCTION

Environmental Quality Management, Inc. (EQ) has been tasked with performing a time-critical-removal action (TCRA) to remove polychlorinated biphenyl (PCB) contaminated sediments from targeted locations over a 1.8-mile section of Portage Creek. The Portage Creek Area Site (Site) is a portion of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site. Located in Kalamazoo County, Michigan, this site is pervasively contaminated with PCBs as a result of historic waste practices associated with several paper mills. The Site was listed on the National Priorities List (NPL) on August 30, 1990. The Portage Creek Site is located in the City of Kalamazoo, Michigan, beginning at East Cork Street and extending northward approximately 3 miles to the confluence of the Kalamazoo River. Activities associated with this removal action are anticipated to occur in segments along a 1.8-mile stretch of Portage Creek. Work activities will move downstream primarily between Reed Avenue to East Walnut Street bridge, South Pitcher Street bridge to the railroad crossing west of Rochester Street, and the bend in Portage Creek east of Rochester Street to the confluence with the Kalamazoo River (Figure 1, Site Location Map, Attachment 1).

A comprehensive description of the project is provided in the Work Plan (composed of sediment removal area technical memorandums and other site documents) for the Portage Creek Area Time-Critical Removal Action. The section of Portage Creek targeted for action has been divided into 10 distinct removal areas (Figure 2, Sediment Removal Areas, Attachment 1). The areas targeted for removal will be referred to as SA1-A, SA1-B, SA1-C, SA3-A, SA5-A, SA5-C, Axtell Creek, SA5-D, SA6, and SA7. This technical memorandum will focus on establishing support facilities and contaminated sediment removal operations in the SA5 and Axtell Creek Areas. Approaches described in this technical memorandum supersede all other removal approaches discussed to date in related submittals.

2. PROJECT PREPARATION

EQ will perform the following activities to prepare the Portage Creek Area Site for contaminated sediment excavation in SA5 and Axtell Creek.

2.1 Pre-excavation Sampling of Data Gap Area SA5 and Axtell Creek

2.1.1 Sampling

EQ will conduct sampling at dredging area SA5 and Axtell Creek to further define the extent of contamination and to finalize the removal depths required. SA5 and Axtell Creek grids that require pre-dredging sampling are AXC-1, AXC-3, SA5D-1, SA5D-2, SA5D-3, SA5D-4, SA5D-7, SA5D-12, SA5D-14, SA5C-2, SA5C-3, SA5C-4, SA5C-5, SA5A-5, SA5A-6, and SA5A-7. Grids SA5D-1, SA5D-2, SA5D-3, SA5D-4, SA5D-7, SA5D-12, and SA5D-14 were sampled prior to preparation of this plan on August 30, 2011. Analytical results of sampling may impact work described in this Technical Memorandum. Approaches described hereafter may be modified subject to the outcome of the investigation.

Future sampling efforts will be performed jointly with the USEPA START Contractor. EQ will supply sampling equipment and supplies. The START representative will be responsible for preparing and labeling samples, completing chain-of-custody, and packaging samples for shipment. Details regarding sampling, procedures, and protocols are presented in the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP). In addition, EQ will collect samples so that waste characterization analyses can be conducted as part of the process for securing disposal acceptance of the TSCA waste soils/sediments and Subtitle D waste soils/sediments.

2.1.2 Analyses

EQ will provide laboratory analyses of the collected samples. Details regarding sample analyses, turnaround time, and QAQC levels are presented in the FSP and QAPP.

3. SA5 and AXTELL CREEK CONTAMINATED SEDIMENT REMOVAL

The SA5 dredging area lies to the north of the Lake Street bridge and extends north to Walnut Street. SA5 is subdivided into four segments. SA5D extends north of the Lake Street bridge to E Crosstown Parkway. SA5C extends north of E. Crosstown Parkway, to E. Vine Street. SA5B extends northeast from the Vine Street bridge to E. Dutton Street bridge. SA5B is to be re-sampled to verify contaminant levels, and no discussion of dredging work for this dredging area will be addressed in this technical memorandum. SA5A extends northeast from E. Dutton Street Bridge to the Walnut Street Bridge. Dredging will be performed in SA5A, SA5C, and SA5D. The sediment removal depth extends from 30 to 56 inches below the existing creek bottom, which includes an estimated 6 inches of over-dredge depth.

The segment of Axtell Creek to be dredged extends from a storm drain outlet east of the John Street and E Crosstown Parkway intersection and extends east to the confluence with Portage Creek, just west of Upjohn Park. The sediment removal depth for this dredging area extends from 18 to 30 inches below the existing creek bottom, which includes an estimated 6 inches of over-dredge depth.

The overall surface area to be dredged in Axtell Creek and SA5 is anticipated to be approximately 8,387 square yards (sy). The approximate overall dimensions are 2382 ft long by 36 ft wide. EQ will dredge sediments that will require TSCA disposal [approximately 3947 cubic yards (cy)] and sediments requiring non-TSCA disposal at a Subtitle D Landfill (approximately 5,397 cy).

The SA5A Dredging Area is subdivided into 6 grids (SA5A-1 through SA5A-6). SA5A will require additional investigatory sampling but currently has 3 grids that that will be completely disposed of as TSCA waste (SA5A-1, SA5A-5, SA5A-6). SA5A is anticipated to have 2 grids with sediments that will be completely disposed of as non-TSCA waste (Subtitle D Waste) (SA5A-2, SA5A-3). SA5A has only 1 grid that requires both TSCA and non-TSCA disposal

(SA5A-4). The sediment dredging areas are depicted in Attachment 1, Figure 3, SA5A Dredging Area Site Infrastructure. When dredging operations are conducted in Grid SA5A-4, EQ will first remove the TSCA soils in SA5A-4 prior to removing the Subtitle D material. Dredging in this manner will allow for segregation of the TSCA material from the Subtitle D material. Table 1 summarizes current excavation information specific to Area SA5A.

Table 1. SA5A Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
SA5A-1	33'W by 75'L	48"	2475 sf/366 cy	0/0
SA5A-2	37.5' W by 63.5' L	48"	0/0	2381 sf/352 cy
SA5A-3	40'W by 65.5' L	48"	0/0	2653 sf/393 cy
SA5A-4	36.5' W by 67' L	48"	1533 sf/227 cy	912 sf/135 cy
SA5A-5	35' W by 71' L	48"	2485 sf/368 cy	0/0
SA5A-6	33' W by 75' L	48"	2475sf/367 cy	0/0

The SA5C Dredging Area is subdivided into 7 grids (SA5C-1 through SA5C-7). All SA5C grids currently indicate disposal as TSCA waste. Additional investigative samples will be collected in SA5C prior to excavation to confirm TSCA and non-TSCA sediment volumes. The sediment dredging areas are depicted in Attachment 1, Figure 4, SA5C Dredging Area Site Infrastructure. Table 2 summarizes excavation information specific to Area SA5C.

Table 2. SA5C Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
SA5C-1	40.5'W by 85'L	36"	2369 sf/263 cy	0/0
SA5C-2	40.5' W by 56' L	36"	2268 sf/252 cy	0/0
SA5C-3	40.5'W by 56' L	36"	2268 sf/252 cy	0/0
SA5C-4	42.5' W by 56' L	52"	2380 sf/396 cy	0/0
SA5C-5	42.5' W by 65' L	52"	2763 sf/460 cy	0/0
SA5C-6	34.5' W by 63.5' L	52"	2190sf/365 cy	0/0
SA5C-7	34.5'W by 21' L	52"	724 sf/120 cy	0/0

The SA5D Dredging Area is subdivided into 17 grids (SA5D-1 through SA5D-17). SA5D has 1 grid that will be disposed of as TSCA waste (SA5D-17). SA5D will have 8 grids that have sediments that will be disposed of as non-TSCA waste (Subtitle D Waste) (SA5D-1 through SA5D-6, SA5D-13, and SA5D-14). SA5A has 8 grids that require TSCA and non-TSCA disposal (, SA5D-7 through SA5D-12, SA5D-15, and SA5D-16). The sediment dredging areas are depicted in Attachment 1, Figure 5, SA5D Dredging Area Site Infrastructure. When dredging operations are conducted in grids with TSCA and non-TSCA waste, TSCA waste will

typically be removed first; however, this approach will be flexible to adjust for the complexity of the removal grid. This general approach will allow for segregation of the TSCA material from the Subtitle D material. Table 3 summarizes excavation information specific to Area SA5D.

Table 3. SA5D Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
SA5D-1	33.5'W by 76'L	36"	0/0	2546 sf/236 cy
SA5D-2	42' W by 60' L	36"	0/0	2520 sf/280 cy
SA5D-3	42'W by 60' L	36"	0/0	2520 sf/280 cy
SA5D-4	43' W by 60' L	36"	0/0	2580 sf/286 cy
SA5D-5	45' W by 55' L	36"	0/0	2475 sf /275 cy
SA5D-6	43' W by 60' L	18"	0/0	2580sf/143 cy
SA5D-7	45'W by 60' L	30"	195 sf/18 cy	2505 sf/232 cy
SA5D-8	42' W by 60'L	30"	1220 sf/112 cy	1300 sf/120 cy
SA5D-9	42' W by 60'L	30"	782 sf/72 cy	1738 sf/160 cy
SA5D-10	45' W by 56' L	30"	570 sf/52 cy	1950 sf/180 cy
SA5D-11	42' W by 60'L	42"	693 sf/89 cy	1827 sf/237 cy
SA5D-12	39' W by 60'L	42"	420 sf/54 cy	1920 sf/248 cy
SA5D-13	39' W by 64'L	12"	0/0	2496 sf/92 cy
SA5D-14	36' W by 67'L	36"	0/0	2412 sf/268 cy
SA5D-15	38' W by 67'L	42"	2294 sf/382 cy	252 sf/42 cy
SA5D-16	38' W by 68'L	42"	1615 sf/209 cy	969 sf/126 cy
SA5D-17	33' W by 37'L	42"	1221 sf/158 cy	0/0

The Axtell Creek Dredging Area is subdivided into 5 grids (AXC-1 through AXC-5). Axtell Creek has 2 grids that that will be completely disposed of as TSCA waste (AXC-2and AXC-4), 1 disposed of as non-TSCA waste (Subtitle D Waste) (AXC-5) and 2 disposed of as both TSCA and non-TSCA waste AXC-1 and AXC-3. The sediment dredging areas are depicted in Attachment 1, Figure 6, Axtell Creek Dredging Area Site Infrastructure. Table 4 summarizes excavation information specific to Axtell Creek.

Table 4. Axtell Creek Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
AXC-1	16'W by 150'L	24"	598 sf/44 cy	2193 sf/162 cy
AXC-2	25' W by 100' L	30"	2500 sf/231 cy	
AXC-3	24'W by 102' L	24"	1348 sf/10 cy	2314 sf/171 cy
AXC-4	24' W by 98' L	30"	2352 sf/217 cy	0/0
AXC-5	28' W by 60' L	24"	0/0	1680 sf/124 cy

3.1 Pre-Sediment Removal Preparation

3.1.1 Waste Characterization Sampling of TSCA/Subtitle D Soil

EQ will collect characterization soil samples of the TSCA and Subtitle D soils prior to excavation. The EQ FSP dated August 2011 provides information on the number of samples, collection method, and exact analyses to be performed. Both the TSCA and Subtitle D waste soils will be analyzed for landfill disposal parameters.

3.1.2 Pre-Sediment Removal Condition Assessment

EQ will provide a structural engineer to perform a pre-sediment removal assessment of constructed features in and adjacent to the creek channel excavation areas. These constructed features include but are not limited to bridges, storm sewer outfalls, retaining walls, building foundations, and fences. The structural engineer will:

- Inventory the constructed features in the work zones by performing a physical inspection and construction records review.
- Document the pre-existing condition with a written assessment and photographs.
- Prescribe protective measures to maintain the current condition such as (but not limited to) safe set-back distance, shielding, and shoring.

Approaches described in this technical memorandum may be modified subject to the Pre-Removal Condition Assessment.

3.1.3 Temporary Fence Line Installation

EQ will need to install a temporary fence line around SA5D, SA5C, SA5B, and SA5A work areas to control access for public and worker safety. EQ will perform work at the removal areas in ascending order to remove contaminated sediments from upstream to downstream. EQ expects to perform SA5D and Axtell Creek sediment removal somewhat concurrently, while SA5C, SA5B, and SA5A will be performed more consecutively. Therefore, only one removal area will typically be isolated at a time with fencing. As operations are being completed in one removal area, however, preparation activities may begin in the next downstream removal area, which will begin with the erection of a barrier fence line. EQ will install either orange construction fencing or modular chainlink fencing panels to isolate work areas from public

access. However, EQ will use chain link fencing to isolate the SA5D work area from Upjohn Park and the Kalamazoo Youth Center. Footpath access between Upjohn Park and the Kalamazoo Youth Center will remain open through August 20, 2012 to maintain youth programs where access to and from the youth center and the park is required. SA5D will have fencing erected approximately 40 feet from the east bank of the creek (excluding truck turnaround areas at each end) from Lake Street to E Crosstown Parkway to isolate the work area from the remainder of Upjohn Park. Additional fencing will be installed on the west side of the creek to block the pathway connecting the Kalamazoo Youth Center to Upjohn Park after August 20, 2012 as previously mentioned. The fence line installation location is depicted on Attachment 1, Figure 5, SA5D Dredging Area Site Infrastructure.

Temporary fencing will be erected on the eastern side of SA5C approximately 40 feet out from the east bank of the creek to provide a suitable work area along the creek. Temporary fencing will also be installed along the side of the creek approximately 5 to10 feet from the west bank and/or just west of the tree line along the west bank of the creek. Fencing on both sides will extend from E Cross Town Parkway to E. Vine Street. Access gates will be installed on fence lines parallel to E. Vine Street and E Crosstown Parkway for transfer truck access. The fence-line installation location is depicted on Attachment 1, Figure 4, SA5C Dredging Area Site Infrastructure.

EQ will temporarily remove existing fencing that is an obstruction to sediment removal and will re-install fencing upon completion of site activities at the SA5A Dredging Area. EQ will install temporary fencing to isolate the dredging area, staging pad, and transfer truck route, as needed, subject to access restrictions determined by the property owner.

3.1.4 Clearing and Grubbing of Access Road and Excavation Area

Clearing and grubbing will need to be performed at each dredging area covered in this Technical Memorandum. Clearing and grubbing may be very minimal to very extensive subject to the vegetative cover that will restrict access to the dredging areas.

EQ will clear and grub the entire eastern bank of the creek channel along the length of SA5D to facilitate dredging. The southern bank of Axtell Creek will be cleared in vegetated areas up to the confluence with Portage Creek. Clearing and grubbing of vegetation will extend from north of the Lake Street bridge to just south of the E Crosstown Parkway bridge crossing, along the eastern creek bank edge. EQ will selectively clear vegetation from the western bank of the remainder of SA5D by removing limbs and branches that encroach on the dredging area. EQ will perform additional clearing and grubbing from the west bank in the area of Removal Grid SA5D-7 to extend an access road from a temporary bridge installed in SA5D-7 to the east side of the John Street TCRA Staging Pad. This will include a turnout to the north to allow dump trucks to turn around and back up on to the east end of the staging pad. EQ intends to preserve the vegetative cover along the western bank as much as possible. EQ also intends to perform all clearing and grubbing in such a manner to protect the root mass in the overall work area to maintain soil stability. EQ will use a brush hog mower affixed to a posi-track loader to clear underbrush from both creek banks where accessible and as needed.

EQ will clear and grub the entire eastern bank of the creek channel along the length of SA5C to facilitate dredging. EQ will perform limited clearing and grubbing along the western bank of SA5C and selectively clear vegetation from the western bank of the remainder of SA5C by removing limbs and branches that encroach on the dredging area while preserving as much of the vegetative cover along the western bank as much as possible. EQ also intends to perform all clearing and grubbing in such a manner to protect the root mass in the overall work area to maintain soil stability.

EQ will clear and grub the entire eastern bank of the creek channel along the length of SA5A to facilitate dredging. However, EQ will strive to preserve and work around as many of the larger trees along the creek bank as possible. EQ will perform limited clearing and grubbing along the western bank of SA5C by removing limbs and branches that encroach the dredging area. EQ intends to preserve the vegetative cover along the western bank as much as possible and perform all clearing and grubbing in such a manner to protect the root mass in the overall work area to maintain soil stability.

Tree felling may be supported by an excavator with a thumb attachment, and a rubber-tire loader to assist with handling and processing of vegetation. Tree tops and tree trunks will be handled as described in the EQ Debris Management Plan dated September 2011.

3.1.5 Environmental Controls

EQ will install environmental controls per requirements established in the EQ Sedimentation and Erosion Control Plan dated September 2011. These environmental controls will include the following Best Management Practices (BMPs):

- Storm Drain Inlet Protection—EQ will install filtration fabric in storm drain inlets that are potentially impacted by site operations. EQ has identified the following inlets:
    - In the area near SA5A-1, there are 2 storm water inlets on both sides of Dutton Street east of the entrance to the work area for a 12-inch storm drain that require protection.
    - In the area near SA5C-7, there are 2 storm water inlets on both sides of Vine Street east of the exit from the work area for a 24-inch storm drain that require protection.
    - In the area near SA5C-1, there are 2 storm drain water inlets on both sides of E Crosstown Parkway just east of the entrance to the work area for a 12-inch storm drain that require protection.
- Construction Exits—EQ will not need to install a construction entrance for any of the SA5 work areas except for SA5C. The locations of the construction exits are depicted on Figures 3 and 4. Installed construction exits will either consist of an 8-ounce geotextile underlayment with a 6-inch-thick layer of 1- to 3-inch rock or HDPE construction mats or prefabricated steel rumble strips placed over liner material. The construction exits will be approximately 15 ft wide.
- Tire Wash Station—EQ will install and operate a tire wash station(s) just prior to the entrance for the construction exits described above. The tire wash station will consist of a steel box with a steel-grate cover suitable for supporting loaded dump trucks. After each truck is loaded with exhumed sediment, laborer(s) equipped with high-pressure water washer(s) will spray off the dirt from truck tires as they pass through the tire wash station prior to exiting the site. The dislodged dirt and water will be captured in the steel box containment. Wash waters will periodically be pumped or trucked to the waste water treatment plant to maintain suitable storage capacity. Additional periodic maintenance will be required to remove sediment accumulations, which will be solidified and loaded into transfer trucks to be shipped to the John Street TCRA staging pad.
- Paved Surface Management—EQ will provide a power broom with a water tank to perform housekeeping of the paved work areas.
- Dust Control—EQ will provide a water truck for dust control for the mixing area and truck route.

- Fuel Station—EQ will perform fueling of heavy equipment stationed remotely from the John Street TCRA Support area with saddle tanks mounted on EQ/Team Subcontractor service trucks. A designated fueling area will be identified at each of the remote locations where service trucks may pull up near heavy equipment for fueling. EQ will also provide emergency spill control kits that will include drums, oil dry, adsorbent pads, and a boom to address small spills that will be staged adjacent to designated fueling area.
- Sediment Curtain—EQ will install one or more Type II sediment curtains downstream of sediment removal operations perpendicular to the stream flow. Additional curtain(s) will be installed downstream of the cofferdams and bypass pumping discharge pads.
- Silt Fence—EQ will install a silt fence at the bottom of the slope between SA5D-1 and SA5D-17 along the east bank of the creek, at the bottom of the slope between SA5C-1 and SA5C-7along the east bank of the creek, and as needed along the east bank of SA5A. Additional silt fencing will be installed as needed.
- Mulch Blanket—EQ will install additional mulch blanket as needed.
- Rock Discharge Box(es)—When EQ isolates an excavation area, bypass pumping will be required to maintain creek flow. EQ intends to address the entire sediment removal area by dividing it into multiple isolated sections and completing dredging, post removal toe-of-bank stabilization, and backfilling one isolated section at a time before isolating an adjacent section. This may be modified by adding sections if a particular section's dewatering load is determined to be greater than the capacity of the waste water treatment plant. Therefore, EQ will install one or more rock discharge boxes downstream of each isolated section through which the discharge lines of the various bypass pumps will be directed to release their water. The rock discharge box will consist of a 16- to 20-cy rock miser box partially filled with a 2-foot-thick layer of 1- to 3-inch rock placed on the bottom and with multiple perforations through the box's side walls to allow water to exit the box at a dissipated rate. These box(es) will be moved as work progresses.
- Turbidity Monitoring Station—EQ will establish turbidity monitoring station(s) to monitor the turbidity levels during removal operations. Real time turbidity monitoring will be performed with stations set 300 ft upstream, 200 ft downstream, and 300 ft downstream of cofferdams set at each area. Turbidity monitoring will be recorded on half-hour intervals by a programmed data logger at the turbidity station. Other readings may be collected based on field conditions such as presence of visible runoff to the creek in the work vicinity, or as part of mitigation measures. Data will be transferred to a computer in the EQ command post trailer via a cellular modem. Further details concerning turbidity monitoring and corrective action measures are presented in EQ's Field Sampling Plan Portage Creek Removal Area dated August 2011.

Additional environmental controls will be implemented as needed to supplement pre-construction controls as work progresses and site features are impacted by the sediment remediation activities.

3.1.6 Access Road Construction

EQ will need to construct access roads in three areas to facilitate dredging operations. In order to dredge SA5D, an access road extending from Lake Street north to E Crosstown Parkway will need to be constructed parallel to the east side of Portage Creek. Truck turnouts will be installed at the north and south ends of the access roads to allow trucks to turn around in the opposite direction. To facilitate dredging and sediment transfer on Axtell Creek an access road will need to be extended from the edge of the pavement on the northeast corner of the of the John Street TCRA Support Area east to within 30 feet of the confluence with Portage Creek. The third access road that will need to be constructed will run north from E. Crosstown Parkway to Vine Street along the east side of Portage Creek to facilitate dredging and material transfer in the SA5C Dredging Area. The access road layout is depicted on Attachment 1, Figures 4 and 5, SA5C Dredge Area and SA5D Dredge Area, respectively. The access road will serve as a work bench for the excavators when removing sediments from the top of the creek bank, and as a service road to allow sediment transfer vehicles to enter the site, be loaded with sediment, and exit the respective dredging area to transfer material back to the John Street TCRA support facility to stage and stabilize sediments prior to shipment for final disposal. Transfer trucks will enter and exit the sediment removal area through these access roads.

EQ will install an 8-ounce geotextile underlayment with a 6-inch-thick layer of 1- to 3-inch rock covered by a 2- to 3-inch layer of <1 inch gravel or utilize construction mats when traversing over vegetated areas. This roadway will be 20 feet wide where possible to allow for 2-way truck traffic and be a minimum of 12 ft wide where space is limited.

EQ will also need to construct a temporary bridge over Portage Creek and extend an access road from the bridge to facilitate the movement of exhumed sediments to the John Street TCRA Staging Pad from SA5D. The tentative bridge location will be through the SA5D-7 grid Area. EQ intends to use a modular steel/aluminum bridge. Temporary bridge installation will begin with placing 1 to 2 timber mats (if second mat is needed, it will be stacked on the first to obtain ground clearance bridge installation above creek elevation) approximately 1 ft thick by 4 ft wide by 24 ft long at the end of at the creek's edge. A second set of timber mats (stacked 3-5 high) will be placed in the center of the creek channel. If the ground conditions are extremely soft,

single-layer HDPE road mats will be installed as an underlayment for the timber mats to prevent timber mats from sinking into boggy ground conditions. The timber mats, which will act as the foundation for the bridge sections anchoring, will be secured together with cable at each end and in the center to prevent mats from sliding off one another. The bridge will consist of four 5.65-ft-wide by 30-ft sections. The bridge will be laid out two sections wide and end to end, thus creating an 11.3' wide by 60' bridge. The first two bridge sections will be installed on top of the timber mat foundations. The bridge section will be lifted and set on the timber mat foundations with the excavator. Once the first span is installed, the next span will be installed working from the span previously installed following the same general procedure as described earlier. The number of timber mats used for foundation piers will vary to get the base of the bridge 1 to 2 ft above the water surface. EQ anticipates that a minimum of four timber mats will be required for the center stream foundation pier.

Poles with flagging will be attached to the bridge sides to provide a visual indicator of the side edges of the bridge for dump truck drivers to align themselves with when traversing over the bridge.

3.1.7 Dredging Area Isolation

EQ will install a series of sheet pile cofferdams to isolate the dredging areas and facilitate dewatering to permit "dredging-in-the-dry" of the contaminated sediments. EQ intends to subdivide SA5D dredging into five isolated sections to facilitate sediment removal operations. The proposed isolated sections are SA5D 1-4, SA5D 5-8, SA5D 9-12, SA5D 13-15, and SA5D 16-17. EQ intends to subdivide Axtell Creek dredging into two isolated sections to facilitate sediment removal operations. The proposed isolated sections are AXC 1-2 and AXC 3-5. EQ intends to subdivide SA5C dredging into two isolated sections to facilitate sediment removal operations. The proposed isolated sections are SA5C 1-3 and SA5C 4-7. EQ intends to isolate only the TSCA area of SA5B-1 by dredging it by itself. EQ will keep the cofferdam at the downstream end of SA5C-7 in place and place a cofferdam at the downstream end of SA5B-1 TSCA area. EQ intends to subdivide SA5A dredging into two isolated sections to facilitate sediment removal operations. The proposed isolated sections are SA5A 1-3 and SA5A 4-6.

EQ may modify this approach once the dredging activity has started if groundwater recharge conditions exceed waste water treatment system capacity. In addition to installing cofferdams across the creek channel, EQ may install smaller 3-sided cofferdams around storm drain outlets to further isolate the dredging areas from storm water drainage. One known 30-inch outlet in the SA5D dredging area may require a cofferdam, and three known outlets in the Axtell Creek dredging area may also require cofferdams. There are two 60-inch outlets located near the west end of Axtell Creek and one 12-inch outlet in the center of the dredging area. Five known outlets in the SA5C dredging area may require a cofferdam. The SA5C dredging has three 12-inch, one 15-inch, and one 24-inch storm water outlets. Two known outlets in the SA5A dredging area may require a cofferdam. SA5B has one 12-inch outlet that may be in or just downstream from the dredging area. This will need to be verified through surveying. The SA5A dredging area has one 12-inch and one 15-inch storm water outlet. EQ may set by-pass pumps and appropriate hoses/piping to facilitate pumping from the storm outlets to downstream of the excavation areas.

These cofferdams will be completed to an elevation approximately 6 inches above the average creek water level elevation. The elevation completion height has been specified by USEPA to allow storm water overflow into the isolated excavation area in the event of by-pass pumping failure and/or a storm event to prevent upstream flooding due to sediment removal operations.

3.1.8 By-Pass Pumping

EQ will provide a dewatering subcontractor to perform by-pass pumping operations and isolated dredging area dewatering. By-pass pumping will consist of rerouting three distinct sources of water away from the isolated dredging area and discharging it back into the creek below the downstream isolation cofferdam. The three water sources are listed below:

- Creek channel flow
- Storm water outlet flow
- Groundwater recharge to creek

Creek channel by-pass pumping will consist of capturing the stream flow from the creek from above the upstream isolation cofferdam and pumping it past the downstream isolation cofferdam and discharging captured creek waters on a rock discharge pad installed by EQ. By-pass

pumping capacity will be specified to exceed 2 times the average creek flow of approximately 45 cfm. The subcontractor will also be required to provide redundant pumps and ancillary equipment to allow for maintenance of the pumping systems without impacting dredging operations. There may be exceptions to this specification when performing by-pass pumping around isolated areas where suitable work space is unavailable to operate multiple 24-inch discharge lines for redundant pumping systems. By-pass pumping operations will be described in the subsequent water management subsection. The by-pass pumping systems will be installed concurrently with installation of the up/downstream isolation cofferdam. Attachment 1, Figure 7, Typical By-Pass Pumping Layout, depicts the general layout for the pumping equipment and discharge line for the isolated sections undergoing sediment removal. Timber mat bridging will be utilized as needed to bridge over pipelines in work areas.

Storm water outlet by-pass pumping may be performed as needed from storm sewer outfall(s) that have been coffer dammed to prevent flow into an active excavation area. Pumps and ancillary equipment will be sized to meet the maximum capacity of the storm sewer outlets described in Section 3.1.7 of this technical memorandum.

Groundwater by-pass pumping will be performed to minimize groundwater recharge to the isolated creek dredging areas to minimize dredging area sediment dewatering and subsequent waste water treatment. This will be accomplished by installing groundwater depression wells and pumping systems outside of the creek channel boundaries to depress the groundwater table below the maximum excavation depth. The size, number, and location of depression wells will be subject to land access outside the creek channel footprint. Groundwater will be direct discharged into the creek channel downstream onto a rock discharge pad.

3.1.9 Dredging Area Dewatering

EQ will provide a dewatering subcontractor to perform isolated dredging area dewatering. The subcontractor will first pump standing water from the isolated section and discharge it into the 10-inch pipeline to transfer water to the waste water treatment plant located at the John Street TCRA Support Area. The subcontractor will then install a series of 1-inch sipper wells using an excavator with jetting probe. The sipper wells will consist of 1-inch tubes covered by a

geotextile sleeve jetted to an approximate depth of 10 feet below the creek bottom surface elevation. Tubing will connect the sipper wells through a valve control box at 100-foot intervals that will be connected to a manifold pipe. The manifold pipe will be connected to a vacuum pump that discharges into the 10-inch pipeline that transfers recovered water to the waste water treatment plant. A vacuum will be placed on the sipper wells to extract water from the sediment. Several days of pumping will be permitted prior to the start of dredging to remove the maximum amount of moisture from the sediments prior to dredging. This will facilitate sediment removal with minimal solidification at the removal area. Minimizing water content in sediment has the following benefits:

- Requires less solidification material, thus lowering the purchase cost of solidification material.
- Decreases water weight in sediment, thus reducing disposal cost by reducing disposal tonnage.
- Decreases volume of solidification material, thus decreasing waste volume and tonnage disposal costs.
- Reduced use of solidification material reduces dust control issues associated with solidification.

The end result is a cost and safety benefit. Attachment1, Figure 7, Typical Water Management Pumping, depicts the general configuration of groundwater depression wells and isolation area dewatering sipper wells.

3.1.10 Pre-Excavation Topographic Survey

EQ will coordinate with the EPA FIELDS Group to perform a pre-excavation survey of the removal area to fill in data gaps not captured when surveying the transect lines. This survey data will be used for multiple purposes. First, it will document the pre-removal topographical condition of the creek channel. This serves as a baseline to measure the performance of contaminated sediment removal and creek channel stabilization/backfill activities. To accomplish this, the survey data will then be loaded into the Real Time Kinetics–Global Positioning System (RTK-GPS) equipment mounted in the excavators used for dredging to guide excavation/backfill efforts and ensure the lateral/vertical extent of contaminated sediment removal and backfill restoration is performed correctly.

3.2 Contaminated Sediment Removal

Contaminated sediment will be removed in basically the same manner for SA5D, Axtell Creek, SA5C, SA5B 1 TSCA Area, and SA5A. Sediment will be removed from the top of the bank with a long-reach excavator equipped with RTK-GPS equipment. The targeted removal grids will be isolated with sheet pile cofferdams from upstream and downstream in groups of 3 to 4. Bypass pumping will be performed to maintain creek flow and storm water drainage. The isolation area will be de-watered and processed through the waste water treatment plant. Sediments will be solidified sufficiently in place to allow transfer dump trucks to move material to the John Street TCRA Staging Pad for final dewatering/solidification and subsequent shipment for disposal. Exhumed material will be transferred to the John Street TCRA Staging Pad by an off-road dump truck over the site-constructed haul road or by an over-the-road dump truck and public roadways subject to the location of the removal area. Post-removal sampling and surveying will be performed to verify that cleanup objectives have been met. Once isolated removal area objectives have been meet, toe of bank stabilization and backfilling will be conducted along with survey verification. The upstream cofferdam will be removed and re-installed at the downstream end of the next section of removal grids. Water management equipment will be reconfigured for the next section. This overall general process will be repeated until all removal grid sections covered by this technical memorandum have been completed. If and when sufficient water treatment system capacity becomes available, multiple adjacent isolated sections may be addressed simultaneously while working from upstream to downstream. When removal grid(s) containing both TSCA and non-TSCA sediments are excavated, the TSCA portion will typically be exhumed first (when practical) to facilitate segregation on the John Street TCRA Staging Pad and minimize potential for cross contamination from storm events during the removal period. Table 5 summarizes the order for completion and the sediment transfer method to the John Street TCRA Staging Pad.

Table 5. SA5 Sediment Grid Removal Sequence

Sediment Removal Sequence	Slope Area Grids per Removal Section	Transport Method to John Street Staging Pad or Disposal Facility
1	SA5D 1 -4	Off-Road Dump Truck
2	SA5D 5-8	Off-Road Dump Truck
3	AXC 1-2	Off-Road Dump Truck
4	AXC 3-5	Off-Road Dump Truck
5	SA5D 9-12	Off-Road Dump Truck
6	SA5D 13-17	Off-Road Dump Truck
7	SA5C 1-3	Over-the-Road Dump Truck
8	SA5C 4-7	Over-the-Road Dump Truck
9	SA5B 1 TSCA Sediments Only	Over-the-Road Dump Truck
10	SA5A 1-3	Over the Road Dump Truck
11	SA5A 4-7	Over the Road Dump Truck

3.2.1 Water Management

By-pass pumping operations will begin after completion of the dredging area isolation and installation of the by-pass pumping systems. By-pass pumping will operate 24 hours per day 7 days per week until the isolated dredging area is dredged, the area is confirmatory surveyed/sampled, toe of bank stabilization is completed, and the area is backfilled. By-pass pumping will be terminated during rain and associated flooding events that exceed pumping capacity, and creek flow will be permitted to enter the isolated dredging area; by-pass pumping will resume subsequent to flood crest. The discharge of by-pass pumping waters will not require a Substantial Requirements Document (SRD).

Next, the isolation area dewatering pumping system will be operated 24 hours/day 7 days/week until the isolated dredging area is dredged, the area is confirmatory surveyed/sampled, bank stabilization is completed, and the area is backfilled. Isolation area dewatering will be stopped during rain and associated flooding events that exceed pumping capacity, and the creek flow will be permitted to enter the isolated dredging area. Dewatering will resume after the flood crests. Water from the isolation area dewatering will be sent to the waste water treatment plant via pipeline at the John Street TCRA Support Area. The generated waste water will be processed through a series of settling tanks and particulate and chemical filtration media to meet the

requirements of the SRD. The treated waste water will be discharged in compliance with the SRD.

3.2.2 Dredging of SA5D

3.2.2.1 Sediment Removal

EQ will dredge contaminated sediments from the isolated Grid SA5D Grid Areas using a top-of-bank dredging approach subsequent to surface dewatering the isolated sections. Dredging will initially be performed in isolated section Grid Area SA5D 1-4 and then Grid Area SA5D 5-8. Dredging will then switch to Axtell Creek. Subsequent to completing the dredging of Axtell Creek, dredging will continue on SA5D addressing isolated areas in the order presented in Table 5. By-pass pumping and isolation area dewatering equipment and pipelines will be installed on the west side of Portage Creek. EQ will dredge the isolated areas from atop the eastern bank with a long-reach excavator equipped with a RTK-GPS. EQ will solidify sediments in the creek bed or in solidification boxes (as/if needed) to prepare them for transfer to the John Street TCRA Staging Pad. EQ may use one or a combination of three solidification materials that include Calciment ®, crystallized polymer, and/or corn cob grit. If and when a solidification box is used, EQ will place the material into a sediment solidification box that will be pumped free of latent water before solidification. Water will be pumped into a holding tank to allow sediment to settle. Accumulated water from the holding tank will be periodically pumped into the 10-inch transfer pipeline to the John Street TCRA (WWTP). The long-reach excavator will use a smooth-edge bucket to exhume sediments to the target depth for the individual grid area being exhumed, clearing sediment from the west bank to the east bank as removal progresses to the north in a downstream direction. Once sediments are sufficiently solidified, the excavator operator will load transfer dump trucks, and material will be sent to the John Street TCRA Staging Pad.

3.2.2.2 Contaminated Sediment Removal and Transfer to Staging Area

Off-road dump trucks (ORDTs) will access the site from the temporary bridge constructed over Removal Grid SA5D-7. ORDTs will advance to the respective isolation area for loading and will return to the John Street Staging Pad to deposit their loads on the east end of the staging pad. ORDTs will back up an approach ramp to the staging pad, and will raise their dump bed after

cresting the top of the berm. Heavy equipment on the staging pad will remove material from the dump area to ensure ORDTs are not tracking into dumped sediments. ORDTs will then return to isolation areas for continued loading. The load-out area at the creek side will be covered with plastic sheeting draped back into the active excavation area to allow for containment and recovery of spillage from loading operations. Excavator operators will take special care during loading so as to not spill sediment.

3.2.2.3 Post-Excavation Sampling

EQ will support the START contractor in post-excavation sampling of the contaminated soil removal area following the methods and procedures described in the confirmation sediment collection sampling described in the FSP. EQ will provide laboratory analyses through a competitively procured laboratory. Sampling and analyses will be performed in accordance with the QAPP and FSP prepared by EQ for the site dated September 2011 and August 2011, respectively. Sampling locations will be marked in order to document locations during post-excavation survey operations. Turnaround time for sample analyses will be determined at/or near the time of collection subject to time constraints with other site operations. If cleanup performance standards/goals are met in all areas of contaminated soil removal, work will proceed to close out the excavation. If a portion of any area and/or all areas fail to meet performance standards/goals, an additional 6 inches will be excavated and the area re-sampled. The sampling and excavation process will be repeated as needed (or as directed by the EPA OSC) until the entire excavation area meets cleanup performance standards/goals before proceeding with excavation closeout activities.

3.2.2.4 Post-Excavation Survey

EQ will coordinate with the EPA OSC and EPA FIELDS Group to conduct post-excavation surveying as described in the post-excavation surveying of SA5D, and EQ will prepare as-built drawings and make required volume removal calculations.

3.2.2.5 Toe of Bank Restoration

Toe of banks will be restored as described in EQ's Restoration Plan dated September 2011.

3.2.2.6 Backfill of Creek Bottom

Subsequent to toe of bank restoration (if required), EQ will begin deploying a sand and gravel mix (bank run) to backfill the creek bottom in accordance with EQ's Restoration Plan dated September 2011.

3.2.2.7 Post Backfill Survey

EQ will coordinate with the EPA OSC and EPA FIELDS Group to conduct post-excavation surveying of SA5D grids subsequent to successful removal of contaminated soil to cleanup performance standards/goals. The EPA FIELDS Group will perform post-excavation surveying to document removal depths. The EPA FIELDS Group will provide survey data to EQ to generate as-built drawings and make cut-to-fill calculations to determine the volume of contaminated soil removed.

3.2.3 Dredge Axtell Creek

EQ will begin excavating Axtell Creek subsequent to the completion of Grids SA5 1-8. Axtell Creek will be subdivided into two isolation sections as described in Table 5. Dredging will be completed by using a long-reach excavator from atop the southern bank of Axtell Creek to dredge the grid areas in the dry region. Dredging will be conducted from west to east. By-pass pumping and excavation area dewatering equipment/pipelines will be installed along the south creek bank. Timber mat bridges will be installed through the access road along the south bank of the creek to allow ORDTs and heavy equipment to travel over pipelines as needed. A 10-inch HDPE discharge line will be extended to the WWTP at the John Street TCRA Support Area located adjacent to the removal area for processing of isolation area contaminated water.

Solidification/loading/transfer of creek channel sediments will be performed in a similar manner as described in Section 3.2.2 of this Technical Memorandum. Material transfer will be completed by ORDTs traveling to/from the John Street TCRA Staging Pad to the access road along Axtell Creek. Loaded trucks will back onto the west end of the staging pad to dump their loads of sediment. Trucks traveling back to the loading area will exit through the operating truck

wash station and get cleaned before crossing the John Street TCRA Support Area. TSCA and Non-TSCA sediments will be further solidified, as needed, and staged separately for subsequent loading and shipment to their respective disposal facilities.

3.2.4 Dredge SA5C

Dredging in SA5C will be conducted in a similar manner as SA5D. Dredging will be performed south to north in a downstream progression. By-pass pumping and excavation area dewatering equipment will be positioned on the west side of the creek, and excavation will be performed from the east side of the creek. By-pass pumping and isolation area dewatering will be conducted following the same approach previously described. The 10-inch pipeline that coveys isolation area water to the WWTP will be extended from SA5D accordingly, prior to commencement of dredging operations. Note that the pipeline will need to be extended under the bridge at E Crosstown Parkway in order to reach the SA5C removal area.

The difference between SA5C and other areas is how the sediments will be loaded and transferred to the John Street TCRA Support Area. Over-the-road dump trucks will be used to transfer the material over public roads to take material to the John Street TCRA Staging Pad for preparation for final disposition. Transfer trucks will have their loads covered with tarps prior to exiting the removal area. Over-the-road dump trucks depart the John Street Support Area, turning right onto John Street then turning right onto E Crosstown Parkway. Trucks will then turn left onto Jasper Street and proceed north to the intersection with E. Vine Street. Trucks will turn right onto E. Vine Street, and turn right onto the access road built parallel to the east creek bank.

Trucks will proceed south to reach their respective load-out area. Note that SA5C 1 sediments will need to be excavated and staged in removal Grids SA5C 2-3 to allow for truck loading prior to trucks entering the truck wash station set up on the south end of the access road. Loaded trucks will then return to the John Street TCRA staging pad by exiting the removal area and turning right onto E Crosstown Parkway and proceeding west until turning left onto John Street and then turning left into John Street TCRA Support Area and proceeding to the staging pad to

deposit their loads. Trucks will then exit the staging pad through the truck wash station and return for additional loads.

3.2.5 Dredge SA5A

EQ will complete sediment removal at SA5A in a similar manner as SA5D and SA5C. SA5A will be dredged with a long-reach excavator from atop the eastern bank in two isolated sections (SA5A 1-4 and SA5A 5-7). The following paragraphs describe variations to the general approach.

By-pass pumping and isolation area dewatering equipment will need to be stationed along the east bank. The 10-inch HDPE transfer pipeline will need to be extended to the SA5A removal area. This will require installing it under the bridges at E. Vine Street and E. Dutton Street. Timber mat bridges will need to be installed over the pipeline in multiple locations to allow the long- reach excavator to access the creek while being protective of the by-pass and dewatering pipelines.

EQ may need to install shoring structures along the concrete retaining walls located along the creek in this removal area. This will be subject to the pre-removal survey performed by the structural engineer. The type/method of shoring will be designed to enable the structural engineer retained by EQ to perform the pre-removal assessment of structural features.

A small staging pad will need to be constructed just south of the storage building at the site. EQ will construct the staging pad using preformed concrete blocks to create the confining bermed perimeter around the staging pad to facilitate loading and transfer of exhumed sediments back to the John Street TCRA Staging Pad. A 7-ft by 13-ft sump will be excavated down 2 ft in the southwest corner to allow for water accumulation. The ground surface will be graded to promote drainage toward the sump. Then, an 8-ounce geotextile underlayment will be placed over the ground surface as a protective layer for a PVC liner. The PVC liner will be laid out over the interior surface of the staging pad and installed over the concrete blocks and anchored with sand placed on top of the liner outside the perimeter of the concrete blocks. A 4-inch layer of sand will be spread over the liner to act as an under drain to the sump. Additional concrete blocks will

be placed along the two interior sides of the sump to protect sediment material from accumulating in the sump. The sand layer will then be covered with HDPE road mats to provide a working surface for an excavator positioned on the staging pad to load out transfer trucks. Note that the sump will periodically be pumped out and the contents sent to the WWTP at the John Street TCRA Support Area for processing. ORDTs will be utilized to transfer material to the staging pad when excavating the sediments from their isolated areas. A ramp will be constructed of soil and stone along the west-central side of the staging pad to provide access for ORDTs to dump exhumed sediments into the staging pad.

ORDTs will be used to transfer material back to the John Street TCRA Staging Pad. Protocols established earlier in this technical memorandum for truck washing, load covering, etc., will be followed. Trucks will follow basically the same route as used for SA5C, except that they will proceed to E. Dutton Street instead of E. Vine Street. Trucks will enter the site by turning left off E. Dutton Street and proceed to the east side of the staging area where they will be loaded with an excavator positioned within the staging area. The loaded trucks will go past the pad and turn around to exit the site onto E. Dutton Street through the truck wash station, and then turn right onto E. Dutton. The trucks will follow the route used to access the John Street TCRA Support Site in reverse.

3.2.6 Site Restoration

3.2.6.1 Removal of Excavation Facilities and Equipment

EQ will remove non-essential facilities and equipment from the work area to restore the site to pre-existing conditions. The fuel tank, excavation equipment, tire wash station, cofferdams, pumps, pipelines, etc., will be removed.

3.2.6.2 Restoration Planting

EQ will perform restoration planting as described in EQ's Restoration Plan dated September 2011. The final restoration design plan will include stakeholder input accepted by EPA and directed to EQ.

3.2.6.3 Restoration Planting Monitoring

EQ will provide monitoring and corrective action/maintenance for a period of 1 year from the restorative planting date or as directed by EPA in accordance with EQ's Restoration Plan dated September 2011. EQ will also maintain erosion sediment controls until re-vegetation planting is accepted or as directed by EPA.

3.2.6.4 Facility Impact Repair

EQ will make repairs to the sediment removal sites caused by sediment removal operations. EQ, EPA, and appropriate City of Kalamazoo management personnel will review pre-existing photo-documentation to develop a punch list of any necessary repair items to be addressed prior to complete demobilization from the SA5 contaminated sediment removal area. EQ anticipates (at a minimum) that this will include perimeter fence repair/replacement, lawn repair and landscaping of disturbed areas, asphalt/concrete patching, and general housekeeping.

ATTACHMENT 1

FIGURES

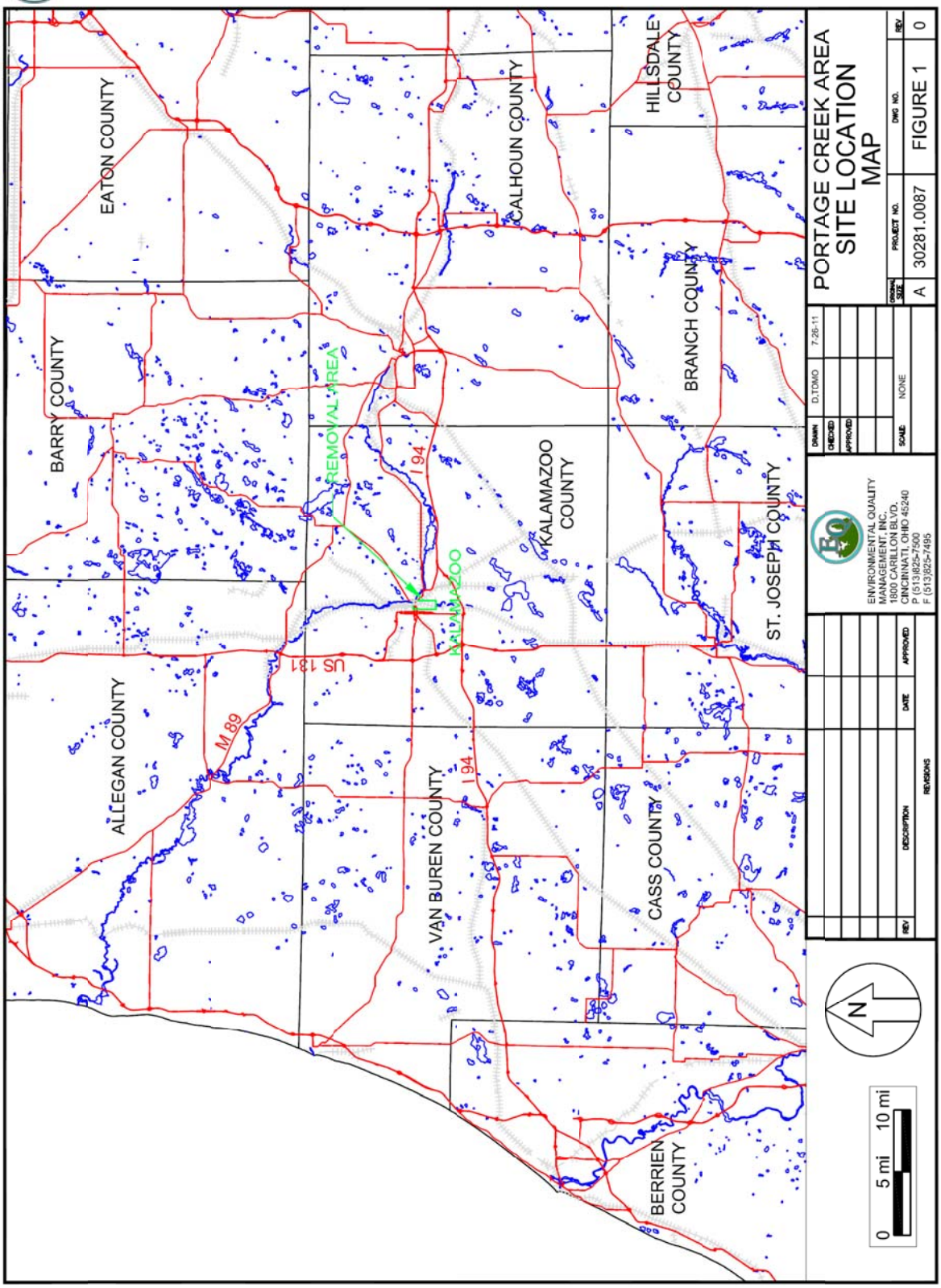

Figure 1. Site Location

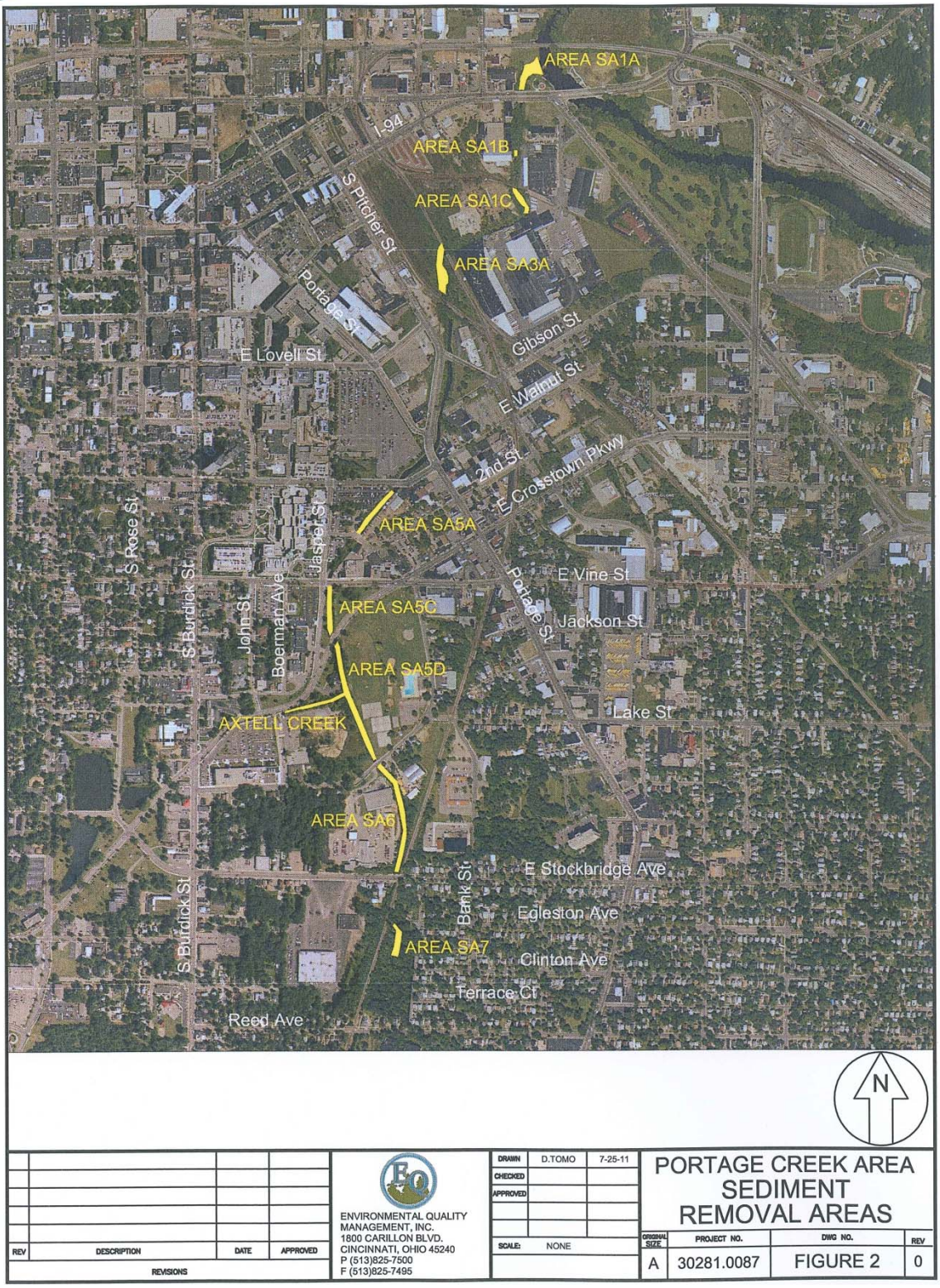

Figure 2. Sediment Removal Areas

Figure 3. Allied Portage Creek SA5A Dredging Area Site Infrastructure

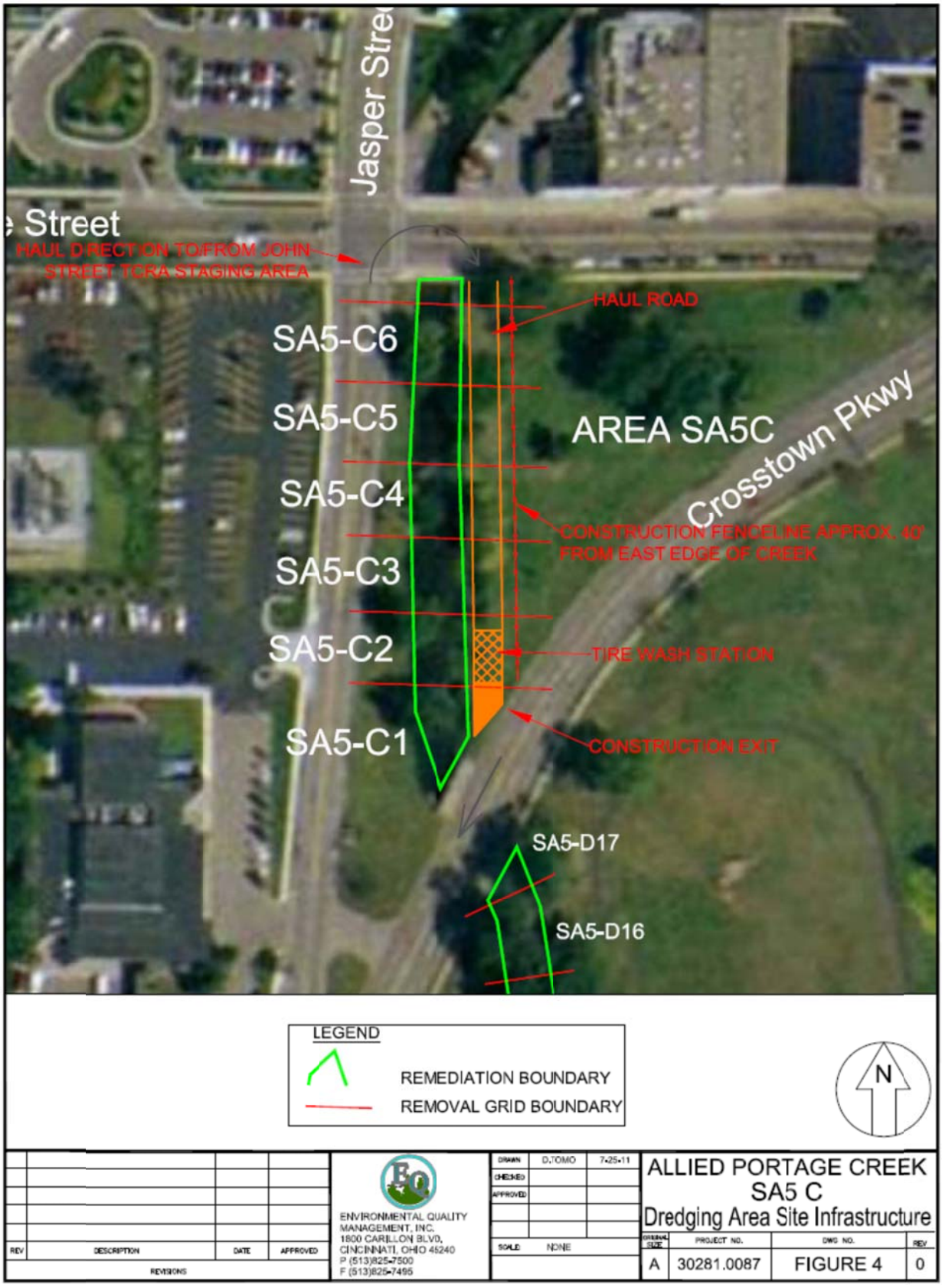

Figure 4. Allied Portage Creek SA5C Dredging Area Site Infrastructure

Figure 5. Allied Portage Creek SA5D Dredging Area Site Infrastructure

Figure 6. Allied Portage Creek Axtell Creek Site Infrastructure

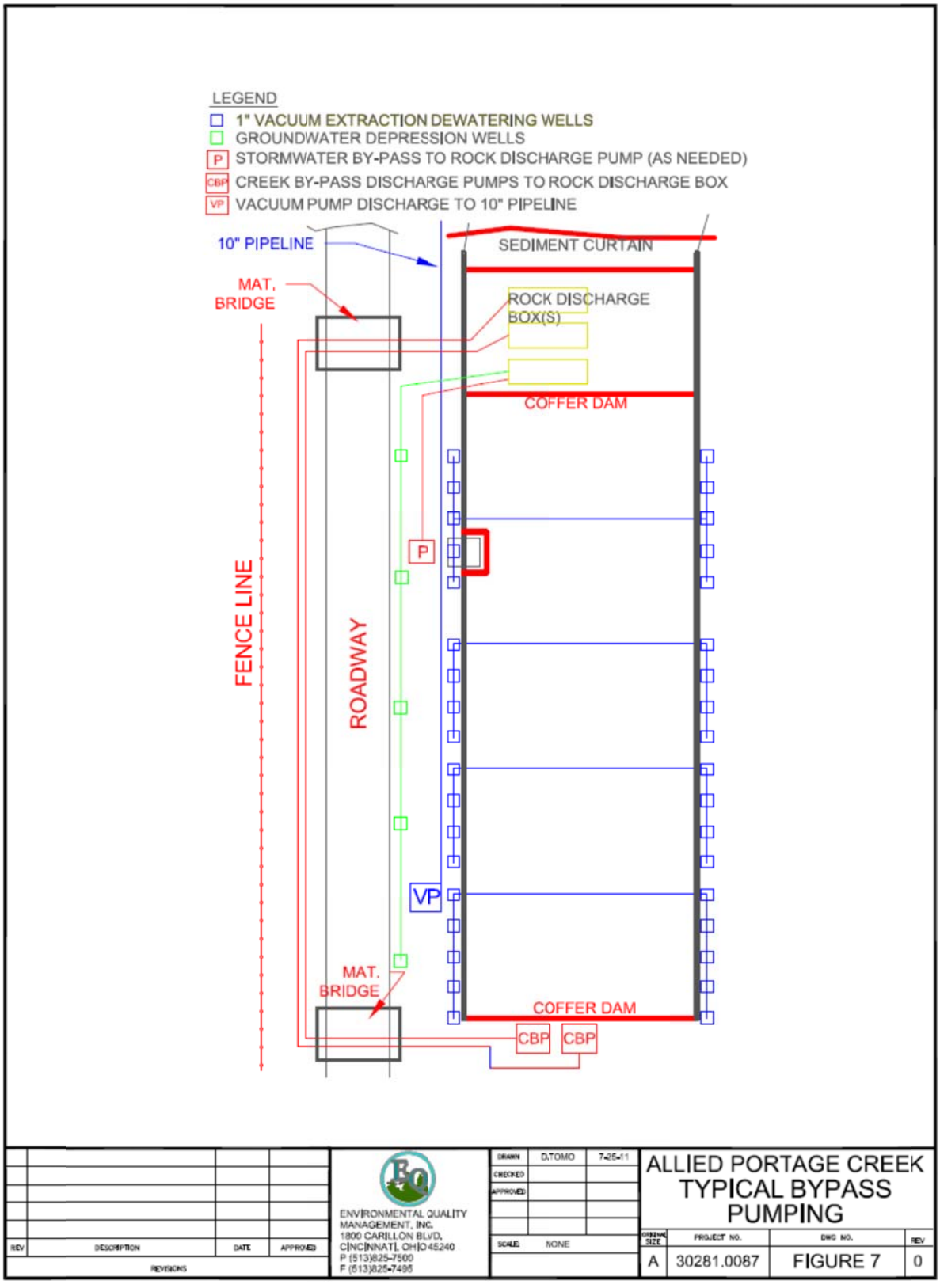

Figure 7. Typical Water Management Pumping